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Resilience Training in the Workplace from 2003-2014:

A Systematic Review

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Abstract

1
2 Over a decade of research attests to the importance of resilience in the workplace for
3 employee well-being and performance. Yet, surprisingly, there has been no attempt to
4 synthesize the evidence for the efficacy of resilience training in this context. The purpose of
5 this study, therefore, is to provide a systematic review of work-based resilience training
6 interventions. Our review identified 14 studies that investigated the impact of resilience
7 training on personal resilience and four broad categories of dependent variables: (a) mental
8 health and subjective well-being outcomes, (b) psychosocial outcomes, (c)
9 physical/biological outcomes, and (d) performance outcomes. Findings indicated that
10 resilience training can improve personal resilience, and is a useful means of developing
11 mental health and subjective well-being in employees. We also found that resilience training
12 has a number of wider benefits that include enhanced psychosocial functioning and improved
13 performance. Due to the lack of coherence in design and implementation, we cannot draw
14 any firm conclusions about the most effective content and format of resilience training.
15 Therefore, going forward, it is vital that future research uses comparative designs to assess
16 the utility of different training regimes, explores whether some people might benefit
17 more/less from resilience training, and demonstrates consistency in terms of how resilience is
18 defined, conceptualized, developed, and assessed.

19 *Keywords:* health, interventions, performance, resilience, systematic review, training, well-
20 being, work

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Practitioner points

- Despite conceptual and theoretical support for resilience training, the empirical evidence is tentative, with the exception of a large effect for mental health and subjective well-being outcomes.
- Most programmes utilize a cognitive-behavioural approach to developing resilience.
- At this stage there is no definitive evidence for the most effective training content or format but it would appear wise to include an element of one-to-one training and support based on individual needs.

Resilience Training in the Workplace from 2003-2014:

A Systematic Review

An established body of research links the psychological well-being of a workforce to work-related outcomes, including individual and organisational productivity (Ford et al., 2011; Taris & Schreurs, 2009). This research suggests that work-based interventions supporting resilience, designed to protect and sustain well-being and performance in the face of adversity, would be likely to deliver benefits for both employees and their organisations. Indeed, numerous studies indicate that training in the effective negotiation of workplace stressors leads to a healthier and more engaged workforce (e.g., Arnetz, Nevedal, Lumley, Backman & Lublin, 2009; McCraty & Atkinson, 2012; Sood, Prasad, Schroeder & Varkey, 2011). Yet, to date, no research has attempted to synthesize these resilience-based interventions. With this in mind, the purpose of the present study is to provide a systematic review of workplace resilience training and its efficacy in bringing about positive changes in personal resilience, mental health, physical/biological outcomes, psychosocial functioning, and job performance.

Interest in the concept of workplace resilience has grown during the period of global recession and subsequent austerity (see Robertson & Cooper, 2013). People in the workplace have heavier workloads now and are working under enormous pressure as we enter the “getting more from less” era (Chartered Institute of Personnel & Development, 2009). This pressure, moreover, has extended to family life as median incomes have depreciated to balance an ailing economy (Office for National Statistics, 2013). Not surprisingly then, during the period of global recession, work-related stress soared by 40% and absentee rates increased by 25% (Houdmont, Kerr, & Addley, 2012). The need for personal resilience, especially in the workplace, has never been greater.

What is Resilience?

1 The word resilience originates from the Latin verb *resilire*, or “to leap back”, and is
2 defined in the Oxford Dictionary of English as “being able to withstand or recover quickly
3 from difficult conditions” (Soanes & Stevenson, 2006, p. 1498). The term’s roots lie in
4 science and mathematics; for example, in physics, resilience is considered to be the “ability
5 of a strained body, by virtue of high yield strength and low elastic modulus to recover its size
6 and form following deformation” (Geller et al., 2003, p. 458). Lazarus (1993) cited the
7 example of elasticity in metals, with a resilient metal bending and bouncing back (instead of
8 breaking) when stressed.

9 Turning to psychological resilience, numerous definitions have been proposed in the
10 research literature (see Windle, 2011). In an attempt to provide definitional and conceptual
11 clarity in this area, Fletcher and Sarkar (2013) recently reviewed and critiqued the variety of
12 definitions, concepts, and theories of psychological resilience. Based on consistent themes
13 emerging from the review, they defined psychological resilience as “the role of mental
14 processes and behavior in promoting personal assets and protecting an individual from the
15 potential negative effect of stressors” (Fletcher & Sarkar, 2012, p. 675; 2013, p. 16). This
16 definition encapsulates aspects of both trait and process conceptualizations of resilience (cf.
17 Fletcher & Sarkar, 2012, 2013). The trait conceptualization suggests that resilience represents
18 a constellation of characteristics that enable individuals to adapt to the circumstances they
19 encounter (cf. Connor & Davidson, 2003). The process conceptualization of resilience
20 recognizes that it is a capacity that develops over time in the context of person–environment
21 interactions (Egeland, Carlson, & Sroufe, 1993). According to Howe, Smajdor, and Stöckl
22 (2012), “it is the dynamic nature of [resilience] which sets this quality apart from related
23 psychological traits such as ‘hardiness’ and ‘mental toughness’ (p. 350). Similarly, Windle
24 (2011) argued that “the defining point which distinguishes hardiness from resilience is that it
25 is a stable personality trait whereas resilience is viewed as something dynamic that will

1 change across the lifespan” (p. 163). Such a perspective is highly significant because it
2 suggests that resilience is a largely malleable phenomenon, and as such it is suitable for
3 intervention. Therefore, critically evaluating the efficacy of interventions committed to
4 developing resilience is extremely important.

5 **Interventions to Enhance Resilience in the Workplace**

6 Germane to the focus of the present study, research on resilience training in the
7 workplace has provided evidence that resilience is amenable to change (e.g., Arnetz et al.,
8 2009; Grant, Curtayne, & Burton, 2009; Sood et al., 2011). Indeed, resilience intervention
9 protocols have yielded adaptive changes in various outcome variables (e.g., well-being,
10 performance). To illustrate, resilience training has been found to have a positive impact on
11 various mental health and subjective well-being outcomes (e.g., lower stress, depression,
12 negative affect) in employees (e.g., Arnetz et al., 2009; Grant et al., 2009; Pipe et al., 2012).
13 In addition, some resilience intervention studies have revealed performance benefits
14 including increases in goal attainment (Grant et al., 2009), productivity (Pipe et al., 2012),
15 and observed behavioural performance (Arnetz et al., 2009). Extant research, therefore,
16 suggests that resilience training can be effective for employees.

17 Notwithstanding the efficacy of resilience interventions, it is important to note that
18 training programmes in the workplace typically vary in content and delivery mode, and have
19 been applied to a variety of occupations (e.g., education, business, medicine, police).
20 Furthermore, there appears to be a lack of coherence and consistency in how resilience is
21 defined, conceptualized, developed, and assessed in resilience training studies. For example,
22 some interventions appear to be inconsistent with the respective resilience definition and
23 measure adopted (see, e.g., Carr et al., 2013; Grant et al., 2009; Pidgeon et al., 2014).

24 **The Present Study**

25 With the variability inherent in resilience training studies to date, it is important that

1 these interventions are synthesized with a view to bringing greater clarity on what does and
2 doesn't work. Hence, this study sets out to provide a systematic review of resilience training
3 in the workplace. Specifically, our goal is to locate workplace resilience interventions and to
4 synthesize their effects on personal resilience and four broad categories of dependent
5 variables: (a) mental health and subjective well-being outcomes, (b) physical/biological
6 outcomes, (c) psychosocial outcomes, and (d) performance outcomes. With this information,
7 we can provide recommendations for subsequent resilience training and intervention
8 research.

9 **Method**

10 **Search Strategy**

11 In April 2014, a computerised literature search of the Cochrane Central Register of
12 Controlled Trials, MEDLINE and PsycINFO was conducted using the search terms resilien*
13 (for resilience, resiliency, and resilient), training, intervention, and work between 1989 and
14 2014. To identify any additional published or unpublished trials, we also searched Google
15 Scholar, Dissertation Abstracts International, and ETHOS online databases. The search
16 included the grey literature, using reference lists and citation searching from reviews and
17 published trials, the Science Citation Index, and also involved consulting noted experts in the
18 field. A digital dropbox was used to store and manage the yielded studies and the flow
19 diagram in Figure 1 depicts the literature retrieval process.

20 [Insert Figure 1 here]

21 **Selection Criteria**

22 Studies were selected for inclusion on the basis of criteria related to Study design,
23 Participants, Interventions and Outcomes (SPIO). SPIO is a variation on PICO (Population,
24 Interventions, Comparison, and Outcomes; Richardson, Wilson, Nishikawa, & Hayward,
25 1995). Datasets were included if they: (a) were published in an English language journal, or

1 were obtained using the procedures described for the identification of unpublished data; (b)
2 were specifically resilience-based interventions; (c) employed a randomised controlled
3 design, controlled design, or any other trial design that yielded quantitative values of all
4 variables and; (d) were conducted in working populations (i.e., employees >18 years old).
5 Personal resilience was the primary outcome sought as well as mental health and well-being
6 outcomes, such as stress, anxiety, and depression. Secondary outcomes included physical
7 health, psychosocial functioning, and job performance. See Table 1.

8 [Insert Table 1 here]

9 **Selection of Papers for Inclusion**

10 The titles and abstracts of the bibliographic records retrieved by the literature searches
11 were screened for relevance using broad inclusion criteria (i.e., resilience and
12 training/intervention). All relevant papers were then screened, using the narrow SPIO criteria,
13 to identify eligible papers. As our narrow search yielded only small numbers, we decided not
14 to further exclude studies on the basis of any methodological criteria. Instead, methodological
15 issues are discussed below and outlined in the evidence table (Table 2). These screening
16 criteria were based on guidelines provided by the Centre for Reviews and Dissemination
17 (CRD; Akers, 2009).

18 **Quality Appraisal**

19 Methodological rigor was assessed using the Cochrane Collaboration's assessment
20 tool (Higgins, et al., 2011). This tool summarises the risk of bias for major outcomes of an
21 intervention trial. The evidence for each individual outcome was graded as low, unclear or
22 high risk. This process included screening for evidence of: (a) concealment of blinding (both
23 participants and assessors), (b) incomplete outcomes data, (c) selective reporting, and (d) any
24 other sources of bias.

25 **Data Extraction**

1 We developed a data extraction tool, which was adapted from a previous systematic
2 review (viz. Simpson et al., 2014). The data extracted included information on study design
3 and methodology, the populations under review, the interventions being employed, and the
4 outcomes reported in each trial. Four reviewers working independently carried out the
5 screening and data extraction. Broad screening was undertaken by MS. Narrow screening was
6 conducted by IR, CC, MS, and TC by splitting up the identified papers (~25%), with each
7 paper being reviewed fully to determine its applicability for inclusion. Any disagreement was
8 adjudicated through group consensus.

9 **Data Synthesis**

10 As the results of the search and review yielded only a small number of heterogeneous
11 interventions ($k = 14$), a quantitative meta-analysis would not provide useful results. Instead,
12 findings are presented in a narrative format.

13 **Results**

14 The search of the databases retrieved 155 records. Following broad and narrow
15 screening (see Figure 1), fourteen papers were considered suitable for inclusion in the review:
16 Abbott et al. (2009), Arnetz et al. (2009), Burton et al. (2010), Carr et al. (2013), Grant et al.
17 (2009), Jennings et al. (2013), Liossis et al. (2009), McCraty and Atkinson (2012), Milllear et
18 al. (2008), Pidgeon et al. (2014), Pipe et al. (2012), Sherlock-Storey, Moss, and Timson
19 (2013), Sood et al. (2011), and Waite and Richardson (2003).

20 **Study Characteristics**

21 **Country of origin.** The fourteen studies originated from four countries. Six were
22 from Australia (viz. Abbott et al., 2009; Burton et al., 2010; Grant et al., 2009; Liossis et al.,
23 2009; Milllear et al., 2008; Pidgeon et al., 2014), one was from Sweden (viz. Arnetz et al.,
24 2009), one was from the United Kingdom (viz. Sherlock-Storey et al., 2013) and six were
25 from the United States (viz. Carr et al., 2013; Jennings et al., 2013; McCraty & Atkinson,

1 2012; Pipe et al., 2012; Sood et al., 2011; Waite & Richardson, 2003). All these countries are
2 classified as individualist, and so can be considered broadly homogenous (Hofstede, 2001).

3 **Study design.** In terms of the design of the studies, eight studies conducted
4 randomized controlled trials (viz. Abbott et al., 2009; Arnetz et al., 2009; Grant et al., 2009;
5 Jennings et al., 2013; McCraty & Atkinson, 2012; Pidgeon et al., 2014; Sood et al., 2011;
6 Waite & Richardson, 2003), two studies conducted (non-randomized) controlled trials (viz.
7 Liossis et al., 2009; Millear et al., 2008), and four studies reported trials with no control
8 group (viz. Burton et al., 2010; Carr et al., 2013; Pipe et al., 2012; Sherlock-Storey et al.,
9 2013).

10 **Data collection.** Regarding data collection, nine out of the fourteen studies (viz.
11 Arnetz et al., 2009; Burton et al., 2010; Carr et al., 2013; Grant et al., 2009; Jennings et al.,
12 2013; McCraty & Atkinson, 2012; Pipe et al., 2012; Sherlock-Storey et al., 2013; Sood et al.,
13 2011) collected data at 2 time points (pre- and post- intervention). Four studies collected data
14 at 3 time points; pre- and post-intervention and at 10-week follow up (viz. Abbott et al.,
15 2009; Waite & Richardson, 2003) and pre- and post-intervention and at 6-month follow up
16 (viz. Liossis et al., 2009; Millear et al., 2008). Finally, one study collected data at four time
17 points; pre- and post-intervention, at 1-month follow up, and at 4-month follow up (Pidgeon
18 et al., 2014). See Table 2.

19 [Insert Table 2 here]

20 **Definition of Resilience**

21 Table 3 outlines the resilience definitions used by the 14 workplace resilience studies.
22 Interestingly, six studies do not provide a guiding definition (viz. Arnetz et al., 2009; Carr et
23 al., 2013; Grant et al., 2009; Jennings et al., 2013; Liossis et al., 2009; Millear et al., 2008).
24 From the six studies that measure resilience (viz. Carr et al., 2013; Grant et al., 2009; Pidgeon
25 et al., 2014; Sherlock-Storey et al., 2013; Sood et al., 2011; Waite & Richardson, 2003), two

1 studies do not provide a guiding definition (viz. Carr et al., 2013; Grant et al., 2009), and one
2 study uses a definition that is not consistent with the resilience measure used (viz. Pidgeon et
3 al., 2014). Thus, only three studies (viz. Sherlock-Storey et al., 2013; Sood et al., 2011; Waite
4 & Richardson, 2003) use definitions in line with the respective resilience measure employed
5 for evaluating the intervention. The implications of this will be discussed later.

6 [Insert Table 3 here]

7 **Intervention Characteristics**

8 **Intervention length.** The resilience training interventions ranged from a single 90
9 minute session (Sood et al., 2011) to 13 weekly sessions (Burton et al., 2010). Other
10 programmes were delivered over a two and a half day retreat (Pidgeon et al., 2014), 3 weeks
11 (Pipe et al., 2012), 4 weeks (Jennings et al., 2013), 5 weeks (Waite & Richardson, 2003), 6
12 weeks (Sherlock-Storey et al., 2013), 7 weeks (Liopsis et al., 2009), 10 weeks (Abbott et al.,
13 2009; Arnetz et al., 2009; Grant et al., 2009), 11 weeks (McCraty & Atkinson, 2012; Milllear
14 et al., 2008), and 12 weeks (Carr et al., 2013).

15 **Intervention content.** In terms of training content, 2 studies (viz. Abbott et al., 2009;
16 Carr et al., 2013) were based on the Penn Resilience Program (PRP; Gillham, Brunwasser, &
17 Freres, 2008) which has provided the foundation for the U.S. Army Master Resilience
18 Training course (MRT; Reivich, Seligman, & McBride, 2011). The PRP was developed at
19 the University of Pennsylvania and focuses on the enhancement of a subset of protective
20 factors identified by Masten and Reed (2002). These include optimism, problem solving, self-
21 efficacy, self-regulation, emotional awareness, flexibility, empathy, and strong relationships.

22 Two studies were based on coaching-related principles (viz. Grant et al., 2009;
23 Sherlock-Storey et al., 2013). Specifically, Sherlock-Storey et al. (2013) used a skills-based
24 coaching approach and Grant et al. (2009) used a developmental or executive coaching
25 approach. Skills-based coaching is typically characterized by a higher level of structure

1 and/or more directive style of coaching, a fairly narrow skill or behavioural focus, and a
2 shorter timescale than development coaching which is typically more complex and emergent
3 in focus, less directive in style, and more about creating the right conditions and
4 ‘psychological space’ for reflective learning.

5 Three interventions used mindfulness- and compassion-based practices (viz. Burton et
6 al., 2010; Jennings et al., 2013; Pidgeon et al., 2014). Burton et al.’s (2010) intervention was
7 based on Acceptance and Commitment Therapy (ACT), which uses acceptance and
8 mindfulness strategies to develop psychological resilience through six core processes:
9 acceptance, cognitive defusion (changing one’s relationship with thoughts), being present
10 (mindfulness), self-as-context, values, and committed action. Jennings et al.’s (2013)
11 intervention introduced a series of mindful awareness practices, beginning with the basic
12 practice of body and breath awareness and extending to activities that promote a mindful
13 approach to daily activities (e.g., standing, walking, being present in front of the classroom).
14 To promote compassion, the intervention introduced “caring practice” and “mindful
15 listening”. Caring practice involved a guided reflection of “loving kindness” focused on
16 generating feelings of care for self and others, and mindful listening exercises were designed
17 to promote the ability to listen to others without judgment. Pidgeon et al.’s (2014)
18 intervention was based on metta, or loving-kindness meditation, described as a mind-training
19 practice utilized to increase feelings of warmth and caring for the self and others. The
20 programme consisted of periods of silence and training in mindfulness and metta skills to
21 increase mindfulness and self-compassion.

22 Two studies (viz. McCraty & Atkinson, 2012; Pipe et al., 2012) were primarily based
23 on self-regulation of stress responses via technology to achieve a more coherent physiological
24 state. Police officers from McCraty and Atkinson’s (2012) study learnt a set of skills that
25 enabled them to self-regulate their mental, emotional, and physical systems. The programme

1 utilized a set of proven techniques and technology (emWave) for achieving coherence. Pipe
2 et al.'s (2012) intervention included a "Transforming Stress" workshop that focused on the
3 impact of stress on the body-mind-spirit and several techniques for learning how to self-
4 regulate stress responses by shifting into a more coherent physiological state. Participants
5 were also given use of an emWave heart rate variability technology, which helped them learn
6 how the techniques were impacting on their stress responses.

7 Five interventions (viz. Arnetz et al., 2009; Liossis et al., 2009; Millear et al., 2008;
8 Sood et al., 2011; Waite & Richardson, 2003) consisted of multimodal cognitive behavioral
9 techniques (e.g., attentional training, energy management, relaxation training, imagery, and
10 self-talk). Arnetz et al.'s (2009) programme consisted of relaxation and imagery training with
11 mental skill rehearsal. The Promoting Adult Resilience (PAR) programme (viz. Liossis et al.,
12 2008; Millear et al., 2008) consisted of seven main topics: (1) understanding personal
13 strengths and resilience, (2) understanding and managing stress, (3) challenging and changing
14 negative self-talk, (4) practicing changing negative self-talk, (5), promoting positive
15 relationships; (6) problem solving and managing conflict, and (7) bringing it together. Sood
16 et al.'s (2011) programme addressed two aspects of human experience, namely attention and
17 interpretation. Participants were also provided with training in a brief structured relaxation
18 intervention (viz. paced breathing meditation). Lastly, Waite and Richardson's (2003)
19 intervention was a biopsychospiritual enrichment programme designed to improve mental
20 and spiritual health. Drawing from multidisciplinary perspectives (e.g., Chi, quanta,
21 collective unconscious), participants learnt skills in using resilience to increase energy and
22 focus energy in performing job functions, and develop interpersonal skills.

23 **Intervention delivery.** There were four main modes of delivery; online training
24 (Abbott et al., 2009), group-based sessions (Burton et al., 2010; Arnetz et al., 2009; McCraty
25 & Atkinson, 2012; Liossis et al., 2009; Millear et al., 2008; Pidgeon et al., 2014; Pipe et al.,

1 2012; Waite & Richardson, 2003), one-to-one training (Sherlock-Storey et al., 2013; Sood et
2 al., 2011) and a combination of group-based sessions with one-to-one training (Carr et al.,
3 2013; Grant et al., 2009; Jennings et al., 2013). Five of the 14 studies provided opportunities
4 for additional training in the form of group-based booster sessions (Jennings et al., 2013;
5 Liossis et al., 2009; Pidegon et al., 2014), a follow-up review session to provide an
6 opportunity for participants to report back informally on how things were going (Waite &
7 Richardson, 2003), and a follow-up session based on individual needs (Sood et al., 2011). See
8 Table 2.

9 **Participant Characteristics**

10 **Demographics.** Across the 14 studies, there were a total of 800 participants. The
11 mean age of the participants ranged from 30 to 50, based on the 12 studies that provided this
12 information (excluding Arnetz et al., 2009; Carr et al., 2013). For the 12 studies that provided
13 information about gender split (excluding Carr et al., 2013; Millear et al., 2008), there
14 appeared to be a bias to either predominantly male (see, e.g., Abbott et al., 2009; Arnetz et
15 al., 2009; McCraty & Atkinson, 2012) or predominantly female (see, e.g., Grant et al., 2009;
16 Jennings et al., 2013; Pidgeon et al., 2014) participants. The only exception was the study by
17 Sood et al. which had an approximately balanced split between both genders (53% male and
18 47% female).

19 **Occupations.** The participants were comprised of sales managers from an industrial
20 organization (Abbott et al., 2009), police officers (Arnetz et al., 2009; McCraty & Atkinson,
21 2012), administrative staff from a university (Burton et al., 2010), U.S. Armed Forces
22 personnel (Carr et al., 2013), executives and senior managers from a public health service
23 agency (Grant et al., 2009), public school teachers (Jennings et al., 2013), civil servants
24 (Liossis et al., 2009; Waite & Richardson, 2003), employees of a resource sector company
25 (Millear et al., 2008), human service professionals from a not-for-profit community

1 organization (Pidgeon et al., 2014), nurses in an oncology inpatient hospital unit (Pipe et al.,
2 2012), public sector middle-managers (Sherlock-Storey et al., 2013), and Department of
3 Medicine (DOM) physicians at a tertiary care medical center (Sood et al., 2011). See Table 2.

4 **Outcomes**

5 The primary aim of this review was to examine the effect of resilience training on
6 personal resilience (see Table 4) and four broad categories of dependent variables relating to
7 mental health and subjective well-being outcomes (see Table 5), physical/biological
8 outcomes (see Table 6), psychosocial outcomes (see Table 7), and performance outcomes
9 (see Table 8). Statistically significant results and (non-significant) medium-large effect sizes
10 for the dependent variables in each study are noted below.

11 [Insert Tables 4-8 here]

12 **Resilience.** Significant increases in resilience were demonstrated post-intervention by
13 police officers from Sood et al. ($d = 1.16, p = .0003$), executives and senior managers from
14 Grant et al. ($p < 0.05$), and middle-managers from Sherlock-Storey et al. ($d = .71, p = .01$)
15 post-intervention. Interestingly, while all of the aforementioned studies revealed positive
16 changes in resilience post-intervention, U.S. Army personnel from Carr et al. exhibited
17 significant decreases in resilience ($d = -.20, p = .03$) post-intervention. This finding will be
18 discussed later.

19 **Mental health and subjective well-being outcomes.** Physicians from Sood et al.
20 demonstrated significant decreases in stress ($d = -1.01, p = .01$) and anxiety ($d = -1.32, p =$
21 $.001$) and significant increases in quality of life ($d = .83, p = .03$) post-intervention. Nurses
22 from Pipe et al. demonstrated significant reductions in stress ($d = -1.28, p < .01$), anxiety ($d =$
23 $-1.38, p < .01$), and depression ($d = -1.54, p < .01$) post intervention. Employees from Millear
24 et al. displayed significant reductions in stress post-intervention ($d = -.46, p = .003$) and at 6-
25 month follow up ($d = -.96, p = .001$). Police officers from Arnetz et al. reported significant

1 decreases in negative mood ($d = -1.11, p = .03$) and non-significant but large reductions in
2 stress ($d = -.80, p = .13$) post-intervention. Public school teachers from Jennings et al.
3 displayed non-significant but moderate decreases in depression ($d = -.45, p = .15$) post-
4 intervention. Police officers from McCraty and Atkinson demonstrated significant reductions
5 in depression ($d = -.75, p = .01$), distress ($d = -.62, p = .03$), and negative emotion ($d = -.65, p$
6 $= .02$) and non-significant but moderate increases in vitality ($d = .53, p = .06$) post-
7 intervention. Civil servants from Liossis et al. displayed significant increases in vigour ($d =$
8 $.81, p = .05$) and non-significant but large increases in psychological well-being ($d = .76, p =$
9 $.07$) at 6-month follow up. Administrative staff from Burton et al. demonstrated significant
10 decreases in stress ($p < .05$) and significant increases in positive affect ($p < .01$), autonomy (p
11 $< .05$), mastery ($p < .01$), growth ($p < .01$), and self-acceptance ($p < .05$) post-intervention.
12 Lastly, executives and senior managers from Grant et al. exhibited significant decreases in
13 depression ($p < .05$) and significant increases in subjective well-being ($p < .05$) post-
14 intervention.

15 **Physical/biological outcomes.** Police officers from Arnetz et al. demonstrated non-
16 significant but large reductions in cortisol ($d = -.89, p = .43$) and significant increases in
17 antithrombin ($d = 1.03, p = .04$) post-intervention. Nurses from Pipe et al. exhibited
18 significant decreases in fatigue ($d = -1.44, p < .01$) and public school teachers from Jennings
19 et al. revealed non-significant but moderate decreases in physical ill-being ($d = -.45, p = .15$)
20 post-intervention. Civil servants from Liossis et al. demonstrated significant decreases in
21 exhaustion post-intervention ($p < .05$) and at 6-month follow-up ($d = -.77, p = .01$). Police
22 officers from McCraty and Atkinson displayed significant decreases in rapid heart rate ($d = -$
23 $.64, p = .01$) and administrative staff from Burton et al. exhibited significant decreases in total
24 cholesterol ($p < .05$) post-intervention.

25 **Psychosocial outcomes.** Middle-managers from Sherlock-Storey et al. displayed

1 significant increases in hope ($d = .83, p = .002$), optimism ($d = .81, p = .002$), and self-
2 efficacy ($d = .97, p = .01$) post-intervention. Nurses from Pipe et al. reported significant
3 increases in positive outlook ($d = 1.09, p < .01$), motivation ($d = 1.05, p < .01$), and calmness
4 ($d = 1.46, p < .01$), and significant decreases in resentment ($d = -1.04, p < .01$) and anger
5 management ($d = -.95, p < .01$) post-intervention. Civil servants from Liopsis et al. exhibited
6 significant increases in coping self-efficacy post-intervention ($d = 1.17, p = .001$) and non-
7 significant but large increases at 6-month follow up ($d = .70, p > .05$), significant increases in
8 work-life fit post-intervention ($d = .74, p = .001$) and at 6-month follow up ($d = .44, p < .05$),
9 significant increases in work-life balance post-intervention ($d = .43, p = .04$) and at 6-month
10 follow up ($d = 1.19, p = .001$), and significant increases in optimism ($d = .74, p = .02$) and
11 work satisfaction ($d = .85, p = .01$) at 6-month follow up. Employees from Millear et al.
12 displayed significant increases in coping self-efficacy post-intervention ($d = 1.12, p = .004$)
13 and at 6-month follow up ($d = 1.14, p = .002$). In addition, significant increases in work-life
14 fit were found by Millear et al. at 6-month follow up ($d = .28, p = .05$). Public school teachers
15 from Jennings et al. exhibited significant increases in self-efficacy ($d = .60, p = .002$) and
16 perceived accomplishment ($d = .40, p = .05$) post-intervention. Civil servants from Waite and
17 Richardson demonstrated significant increases in job satisfaction ($d = .40, p = .02$) and
18 interpersonal relations ($d = .35, p = .04$) post-intervention. Police officers from McCraty and
19 Atkinson demonstrated non-significant but large increases in peacefulness ($d = .51, p = .06$)
20 post-intervention and administrative staff from Burton et al. demonstrated significant
21 increases in mindfulness ($p < .05$) and acceptance ($p < .05$) post-intervention.

22 **Performance outcomes.** Executives and senior managers from Grant et al.
23 demonstrated significant increases in goal attainment post-intervention ($p < 0.05$), nurses
24 from Pipe et al. exhibited significant increases in productivity post-intervention ($d = .97, p <$
25 $.01$), and police officers from Arnetz et al. displayed significant increases in observed

1 behavioral performance post-intervention ($d = 1.26, p = 0.02$).

2 **Methodological Quality of Included Papers**

3 For the randomized and non-randomized controlled trials (10 studies viz. Abbott et
4 al., 2009; Arnetz et al., 2009; Grant et al., 2009; Jennings et al., 2013; Liossis et al., 2009;
5 McCraty & Atkinson, 2012; Millear et al., 2008; Pidgeon et al., 2014; Sood et al., 2011;
6 Waite & Richardson, 2003), quality was assessed using the Cochrane Collaboration tool for
7 Risk of Bias (Higgins et al., 2011). None of the studies adequately described evidence of
8 sequencing at the randomization stage, and Millear et al. (2008) and Liossis et al. (2009) did
9 not use random assignment but had independently selected experimental and control groups.
10 Likewise, across the studies, allocation to experimental and control groups was either not
11 well concealed or had insufficient information to make an inference. Blinding of the assessors
12 and outcome assessment was not reported in any of the reviewed studies. However, five of
13 the ten studies (viz. Jennings et al., 2013; Liossis et al., 2009; McCraty & Atkinson., 2012;
14 Pidgeon et al., 2014; Sood et al., 2011) did describe incomplete outcome data, including
15 attrition rates, and there was only evidence of outcome reporting bias (i.e., the selective
16 reporting of some outcomes but not others, depending on the nature and direction of the
17 results) in two trials (viz. Abbott et al., 2009; Pidgeon et al., 2014). Finally, baseline
18 measures were statistically controlled for in 4 of the 10 studies (viz. Jennings et al., 2013;
19 Liossis et al., 2009; Millear et al., 2008; Sood et al., 2011) but were either omitted or unclear
20 in the others. Overall, the risk of bias in the reviewed studies was typically high (see Table 9).

21 [Insert Table 9 here]

22 **Discussion**

23 The purpose of this study was to synthesize research on resilience training in the
24 workplace and to specifically evaluate the effect of training on personal resilience and four
25 broad categories of dependent variables: (a) mental health and subjective well-being

1 outcomes, (b) physical/biological outcomes, (c) psychosocial outcomes, and (d) performance
2 outcomes. In general, the studies offer support for the positive impact of resilience training.
3 In 13 of the 14 reviewed studies there was a statistically significant change in at least one of
4 the dependent variables. Furthermore, in 12 of the 14 studies, the direction of the results is in
5 favor of a beneficial effect for the training. On the other hand, there is no single dependent
6 variable that shows a statistically significant effect across all of the studies in which it was
7 investigated.

8 **Is Resilience Training Effective?**

9 **Does resilience training enhance resilience?** Six studies (viz. Carr et al., 2013;
10 Grant et al., 2009; Pidgeon et al., 2014; Sherlock-Storey et al., 2011; Sood et al., 2011; Waite
11 & Richardson, 2003) measured resilience, with 3 out of the 6 showing a significant positive
12 effect (viz. Grant et al., 2009; Sherlock-Storey et al., 2013; Sood et al., 2011). Interestingly,
13 despite the training, Carr et al. found that resilience (and morale) declined in U.S. Army
14 personnel across the deployment period. A possible explanation for this finding is that the
15 lower morale may have reflected less perceived helplessness of behavior by commanders and
16 yielded an impression that such programmes do not provide benefit. In that circumstance,
17 resilience programmes may be implemented with low priority of commitment, compromising
18 whatever benefit may be present. Consequently, Carr et al. proposed that “appropriately cast
19 expectations for the effects of such programs are essential for their implementation” (p. 153).

20 **Mental health and subjective well-being outcomes.** The most frequently studied
21 category of dependent variables was mental health and subjective well-being. Within this
22 category, the most frequently studied outcomes were depression, stress, negative
23 mood/affect/emotion, and anxiety. A sample size weighted mean effect size based on the 13
24 effect sizes available for this cluster of variables gives a value of $d = 0.78$ (a large effect).
25 This is a bigger effect than those observed by Brunwasser et al. (2009) in their evaluation of

1 the Penn Resiliency Program (PRP) for youths. Overall, the Brunwasser et al. effect sizes
2 ranged from 0.11-0.21, although they did find larger effects for some of the subgroups in
3 their sample (up to 0.31). They also found that effects were more stable for longer follow-up
4 periods. It was not possible to examine the impact of follow up period in our study but it is
5 something that should be a point of focus for future research.

6 **Psychosocial outcomes.** The majority of the studies (excluding Abbot et al., 2009;
7 Arnetz et al., 2009) also investigated psychosocial outcomes as dependent variables. Three
8 such studies (viz. Jennings et al., 2013; Pidegon et al., 2014; Sherlock-Storey et al., 2013)
9 measured self-efficacy, with all showing a positive effect. In addition, results for other
10 psychosocial outcomes (e.g., work satisfaction, social skills) were generally in the direction
11 of a beneficial effect, but most of the effect sizes were too small to reach statistical
12 significance, given the sample sizes used in the studies.

13 **Physical/biological outcomes.** Seven studies examined physical/biological outcomes.
14 The results, however, provide very few statistically significant effects. Similarly, most of the
15 effect sizes observed, regardless of statistical significance, were small-to-moderate in
16 magnitude. There were, though, two exceptions to this. First, the results of the study by Pipe
17 et al. (2012) showed that resilience training resulted in significantly large reductions in
18 fatigue ($d = -1.44, p < .01$). Second, the results of the study by Arnetz et al. (2009) showed
19 that resilience training resulted in a significantly large increase in antithrombin ($d = 1.03, p =$
20 $.04$), an anticoagulant helpful in preventing thrombosis. The trend in their results for cortisol
21 (a large but not statistically significant effect) also suggests further benefits for resilience
22 training.

23 **Performance outcomes.** Six studies examined performance outcomes, but there was
24 no common dependent variable across these studies. Two studies which assessed observed
25 performance and goal attainment showed positive trends, with a large effect for both of these

1 variables (viz. Arnetz et al., 2009; Grant et al., 2009). Interestingly, there were contrasting
2 results with regards to productivity. Pipe et al. found that resilience training resulted in
3 significantly higher levels of productivity whereas McCraty and Atkinson (2012) found that
4 resilience training resulted in (non-significant) moderately lower levels of productivity.
5 Results for more distal outcomes (viz. gross margin and product sold) showed no indication
6 of any effect.

7 **Summary.** The findings of this review provide some indication that resilience
8 training for workers may have beneficial consequences. This is especially the case for mental
9 health and subjective well-being outcomes, such as stress, depression, anxiety, and negative
10 mood/affect/emotion, which appear particularly sensitive to resilience intervention. There is
11 also an indication, across the studies, that self-efficacy and personal resilience may be
12 improved following training – as would be expected. However, it is noteworthy that only a
13 few studies measured these outcomes and the results available must thus be interpreted
14 cautiously. This is similarly the case for physical/biological and performance outcomes of
15 which indications of efficacy permit only tentative conclusions (since they rely on single
16 studies for most of the outcomes investigated).

17 **The Impact of Resilience Training**

18 As well as considering the impact of resilience training on personal resilience, the
19 potential mechanism by which resilience training may influence other outcomes (viz. mental
20 health and subjective well-being, psychosocial, physical/biological, and performance
21 outcomes) is also of interest. At this stage, it is worth considering a theoretical model for the
22 impact of resilience training on these outcomes. Our preferred definition of resilience
23 (Fletcher & Sarkar, 2012, 2013) suggests that resilience represents a constellation of
24 characteristics that protect individuals from the potential negative effect of stressors. In turn,
25 resilience would act as a mediating variable, such that an increase in resilience would lead to

1 improvements in other outcomes. The results from this systematic review provide tentative
2 support for such a model. Specifically, of the studies that found an improvement in resilience
3 after training (viz. Grant et al., 2009; Sherlock-Storey et al., 2013; Sood et al., 2011), 2 of
4 these studies also measured mental health and subjective well-being outcomes with both
5 studies finding increases in these outcomes. The study that found a decrease in resilience
6 after training (viz. Carr et al., 2013) correspondingly did not show any improvements in
7 mental health and subjective well-being outcomes. Moreover, two studies did not show any
8 significant changes in resilience after training (viz. Pidgeon et al., 2014; Waite & Richardson,
9 2003) and one of these (viz. Waite & Richardson, 2003) measured mental health and
10 subjective well-being outcomes with no change in these either. Although limited in the
11 number of studies, these results are consistent with the interpretation that resilience may
12 mediate the impact of resilience training on certain desirable outcomes.

13 It is reasonable to expect that a primary outcome of interest of resilience training is an
14 improvement in resilience. With this in mind, it is somewhat surprising that only 6 out of the
15 14 studies that we identified measured resilience as an outcome (viz. Carr et al., 2013; Grant
16 et al., 2009; Pidgeon et al., 2014; Sherlock-Storey et al., 2011; Sood et al., 2011; Waite &
17 Richardson, 2003). This limits the evidence about the direct impact of resilience training on
18 personal resilience. Five out of the six studies produced positive results for resilience (viz.
19 Grant et al., 2009; Pidgeon et al., 2014; Sherlock-Storey et al., 2011; Sood et al., 2011; Waite
20 & Richardson, 2003) but only three reached statistical significance (viz. Grant et al., 2009;
21 Sherlock-Storey et al., 2011; Sood et al., 2011). These findings suggest that resilience
22 training may be effective in improving personal resilience but that this is not always the case,
23 suggesting that the effectiveness of the training may be moderated by the nature of training.
24 Next, we consider various factors that may affect the impact of resilience training.

25 **The Nature of Resilience Training**

1 The work-based resilience training studies reviewed here used a number of different,
2 yet inter-related, approaches to developing mental processes and behaviors with the ultimate
3 aim of protection from negative consequences.

4 **Guiding definition, validity of measures, and intervention content.** As mentioned
5 in the Results section, from the six studies that measured resilience (viz. Grant et al., 2009;
6 Carr et al., 2013; Pidgeon et al., 2014; Sherlock-Storey et al., 2013; Sood et al., 2011; Waite
7 & Richardson, 2003), two studies did not provide a guiding definition (viz. Carr et al., 2013;
8 Grant et al., 2009). In addition, Carr et al. and Grant et al.'s interventions appeared to be
9 inconsistent with the measures they employed. For example, Carr et al.'s programme
10 predominantly focused on resilient thinking yet the measure employed, the Connor-Davidson
11 Resilience Scale (CD-RISC; Connor & Davidson, 2003), assesses resilient qualities.
12 Furthermore, Grant et al. used a psychometric tool that measures hardiness, namely the
13 Cognitive Hardiness Scale (Nowack, 1990) but indicated that their training targeted
14 resilience. Importantly, Windle, Bennett, and Noyes (2011) noted that hardiness measures
15 “do not fit well with the notion of resilience as a dynamic process” (p. 8).

16 From the 4 studies that measured resilience and provided resilience definitions, 1
17 study (viz. Pidgeon et al., 2014) used a definition that was not consistent with the resilience
18 measure and intervention employed. Specifically, Pidgeon et al. defined resilience as
19 “competence to cope and adapt in the face of adversity and to bounce back when stressors
20 become overwhelming” (p. 355). Notwithstanding the conceptual distinction between
21 resilience and coping (see, for a review, Fletcher & Sarkar, 2013), the Resilience Scale (RS;
22 Wagnild & Young, 1993) used by the authors is based on 5 characteristics (viz. perseverance,
23 equanimity, meaningfulness, self-reliance, and existential aloneness) that do not appear to be
24 covered directly in the intervention. Only 3 studies (viz. Sherlock-Storey et al., 2013; Sood et
25 al., 2011; Waite & Richardson, 2003) used definitions in line with the respective resilience

1 measure employed. For example, Sherlock-Storey et al. defined resilience as “when beset
2 with problems and adversity sustaining and bouncing back and even beyond to attain
3 success” (p. 22) which is consistent with the resilience coaching programme delivered in the
4 face of organizational change and also in line with Luthans, Youssef, and Avolio’s (2007)
5 conceptualization and operationalization of resilience within their measure of psychological
6 capital (see also Youssef & Luthans, 2007). As a further example, Waite and Richardson
7 defined resilience as “the force within everyone that drives them to seek self-actualization,
8 altruism, wisdom, and be in harmony with a spiritual source of strength (Richardson, 2002)
9 (p. 179)”. This definition is consistent with their biopsychospiritual enrichment programme
10 designed to improve mental and spiritual health, and their corresponding assessment of
11 Resilience and Reintegration (RES) measured “to reflect the . . . concept of reintegration as
12 detailed by Richardson (2002)” (p. 179). However, it is worth noting that, despite the content
13 validity of Waite and Richardson’s programme, it has been argued that “the suggestion by
14 Richardson that resilience may be the driving force that controls the universe may be a little
15 overstated” (Windle, 2011, p. 165).

16 **Intervention length and delivery.** The structure, duration, and delivery method for
17 the interventions varied considerably. The most common format involved group-based
18 training over a 10-11 week period. The limited evidence base currently available does not
19 suggest that longer programmes produce better results. For example, a 30-hour intensive
20 training programme provided for school teachers (Jennings et al., 2013) produced several
21 positive results but so did a 90 minute programme for physicians (Sood et al., 2011). Some
22 programmes offered individual support for trainees. The most extensive individualized
23 programme was that of Grant et al. (2009). This programme did produce several beneficial
24 effects and so did other programmes offering individual support (Jennings et al., 2013; Sood
25 et al., 2011). The evidence is too limited to support a conclusion that individualized training

1 is critical in overall effectiveness, since some programmes without this element also
2 delivered beneficial results. Yet, the results do suggest that, until conclusive evidence is
3 available, it may be wise to include individual support in any resilience training programme.

4 One of the programmes (viz. Abbot et al., 2009) was delivered online. It is interesting
5 to note that this intervention was 1 of the only 2 studies in the review to produce no positive
6 results (see also Carr et al., 2013). Previous research has shown that online interventions can
7 be effective in changing health-related behavior (Portnoy et al., 2008). However, many
8 interventions fail to work due to the lack of take-up (Bennett & Glasgow, 2009). Indeed,
9 Abbot et al. (2009) note that a high proportion of their sample did not complete the training
10 and this may go some way to explain the lack of effects for their intervention.

11 **Building adversity into resilience training.** Two studies (viz. Arnetz et al., 2009;
12 McCraty & Atkinson, 2012) built adversity into their resilience training programmes by
13 systematic exposure to realistic critical incident simulations. To illustrate, police officers in
14 Arnetz et al.'s study participated in a live, life-like critical incident simulation involving the
15 reenactment of a post office robbery. Similarly, a total of 3 different scenarios (viz. a building
16 search, high speed car pursuit, domestic violence episode) were conducted over the course of
17 McCraty and Atkinson's study. Drawing from theories of stress inoculation (Meichenbaum,
18 1985), it has been suggested that exposure to adversity in moderation can help individuals to
19 develop resilience in the face of future pressure situations (cf. Sarkar & Fletcher, 2014;
20 Seery, 2011; Seery, Holman, & Silver, 2010). For example, in the context of elite sport,
21 researchers have found that adversity-related experiences are vital in the development of
22 superior Olympic performance (Howells & Fletcher, 2015; Sarkar, Fletcher, & Brown, in
23 press). Practically, this suggests that psychologists should seek to create an environment with
24 regular appropriate challenges that help individuals to develop resilience; however, there may
25 be a point when these practices contribute to or become inappropriate adversities that have a

1 negative impact on performance and/or well-being. Practitioners therefore need to maintain a
2 reflective outlook that constantly reviews the consequences of their practices (cf. Ashby,
3 Ryan, Gray, & James, 2013) because, if they do become an active agent in an (inappropriate)
4 adversity, it is likely to compromise their ability to facilitate resilience.

5 **Limitations and Future Research**

6 The major limitation of the research reported in this paper is the shortage of studies
7 evaluating work-based resilience training, indicating a need for further systematic research in
8 this area. As Table 9 indicates, the research that is available is not methodologically strong,
9 limiting the possibility of drawing clear conclusions about the efficacy of resilience training
10 and further supporting the need for researchers to execute well-designed studies that
11 minimize threats to external validity. Interestingly, the (two) studies employing randomized
12 controlled designs and possessing the least risk of bias (viz. Jennings et al., 2013; Sood et al.,
13 2011) provided generally positive results in favor of the resilience training. Furthermore,
14 statistical power is an issue in many of the studies reported. Sample sizes are generally small
15 (mean $N = 57$) indicating that the average statistical power in the studies is less than 70% (for
16 a medium effect at .05, two tailed; Cohen, 1988). Although we appreciate the difficulties in
17 recruiting and retaining participants for the studies that are needed, it will be helpful if
18 researchers in the future aim to conduct studies that provide higher levels of statistical power
19 whenever possible.

20 As mentioned previously, the resilience training typically used content derived from a
21 common base of research and theory (i.e., cognitive behavioral techniques). Yet, the training
22 delivery modes nevertheless varied in content and formats (e.g., the Penn Resilience
23 Program, coaching-related principles, mindfulness and compassion-based practices, and self-
24 regulation of stress responses). The studies available, thus, do not enable concrete
25 conclusions about the most effective design and delivery of resilience training. Further

1 comparative research with work samples, designed to isolate and compare different design
2 and delivery features (e.g., length, number of sessions, degree of individualized support,
3 specific content) and target groups would be particularly helpful. Moreover, pursuing an
4 array of research strategies (e.g., case studies) would accelerate the growth in understanding
5 the key features that influence the success of resilience training. As part of this
6 recommendation, it would be interesting to explore whether some people might benefit
7 more/less from resilience training particularly with regards to personality variables (cf. Lu et
8 al., 2014), which currently do not appear to be used or measured in existing training
9 programmes. This comparison may then be extended to other populations where resilience
10 training has been carried out (see, for a review, Brunwasser et al., 2009; Leppin et al., 2014).

11 Before addressing these questions, a more fundamental issue for researchers to
12 consider is the content and construct validity for their resilience training programmes.
13 Specifically, it is essential that future interventions demonstrate consistency in terms of how
14 resilience is defined, conceptualized, developed, and assessed. Based on the findings of this
15 review, there is a particular need for conceptual clarity. This requirement is supported by
16 Fletcher and Sarkar (2012) who argued the following when discussing the content of
17 resilience training:

18 From a research perspective, although resilience intervention studies are required . . . ,
19 it is important that such work is grounded in systematic resilience research programs
20 rather than piecemeal and incomplete strategies based on, for example, the mental
21 toughness, hardiness or coping literatures. Such research programs, which should be
22 underpinned by the conceptual and theoretical advances already made in this area in
23 general psychology (cf. Fletcher & Sarkar, 2013), will provide the most rigorous and
24 robust platform from which to develop resilience training” (p. 676).

25 In addition to demonstrating conceptual clarity and consistency, researchers need to

1 be clearer and more coherent in terms of how resilience interventions are assessed and
2 evaluated. With regards to measuring resilience, since a number of existing questionnaires
3 measure phenomena that are related to resilience but are conceptually distinct from the
4 construct (e.g., hardiness, recovery, coping), evaluators of resilience training need to employ
5 measures that do not divert researchers' attention from examining the true nature of resilience
6 (cf. Sarkar & Fletcher, 2013). In this regard, future researchers should consider assessing and
7 evaluating resilience through the lens of interactionism (see, for a review, Pangallo, Zibarras,
8 Lewis, & Flaxman, 2015) in line with the definition presented in the Introduction section (cf.
9 Fletcher & Sarkar, 2012; 2013) and the process conceptualization of resilience, which
10 recognizes that it is a capacity that develops over time in the context of person-environment
11 interactions (cf. Egeland et al., 1993). Furthermore, since most of the resilience inventories to
12 date have been developed for use in clinical settings (cf. Pangallo et al., 2015; Sarkar &
13 Fletcher, 2013), researchers should consider using more contextually-relevant measures
14 including the Resilience at Work Scale (RAW; Winwood, Colon, & McEwen, 2013), and the
15 Workplace Resilience Inventory (WRI; McLarnon, & Rothstein, 2013). In Table 10, we
16 provide specific guidelines on how future researchers can advance knowledge about
17 resilience training to improve work-related resilience intervention research.

18 [Insert Table 10 here]

19 **Concluding Remarks**

20 As Cooper, Flint-Taylor, and Pearn (2013) suggest with respect to resilience training
21 and its importance in the future, “. . . resilience-building has shifted from a narrow focus as a
22 remedial or preventative measure designed to cover stress and anxiety . . . to a broader focus
23 as capacity or strength-builder to enable people, teams and organizations to sustain high
24 levels of performance in challenging and difficult circumstances” (p. 204). Concerns about
25 individual and organizational resilience are now center-stage in human resource management

1 and occupational psychology not only to enhance productivity but also to foster workplace
2 well-being and engagement. This systematic review is the first step in identifying the impact
3 of resilience training in the workplace, and provides initial evidence of the impact of
4 resilience training on personal resilience, mental health and subjective well-being outcomes,
5 and performance. More work-based studies in this area are required to better enable us to
6 determine which aspects of resilience training are effective and to identify potential
7 mediators. By further exploring and understanding these issues, researchers will not only be
8 able to contribute to the overall success of organizations, but also boost the well-being and
9 engagement of organization members.

References

References preceded by an asterisk were included in the systematic review.

* Abbott, J-A, Klein, B., Hamilton, C., & Rosenthal, A. (2009). The impact of online resilience training for sales managers on wellbeing and work performance. *Electronic Journal of Applied Psychology, 5*, 89-95.

Akers, J. (2009). *Systematic reviews: CRD's guidance for undertaking reviews in health care*. Centre for Reviews and Dissemination.

* Arnetz, B. B., Nevedal, D. C., Lumley, M. A., Backman, L., & Lublin, A. (2009). Trauma resilience training for police: Psychophysiological and performance effects. *Journal of Police and Criminal Psychology, 24*, 1–9. doi: 10.1007/s11896-008-9030-y

Ashby, S. E., Ryan, S., Gray, M., & James, C. (2013). Factors that influence the professional resilience of occupational therapists in mental health practice. *Australian Occupational Therapy Journal, 60*, 110-119. doi: 10.1111/1440-1630.12012

Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the Internet: Actualizing their potential. *Annual Review of Public Health, 30*, 273-292. doi: 10.1146/annurev.publhealth.031308.100235

Brunwasser, S. M., Gillham, J. E. & Kim, E. S. (2009). A meta-analytic review of the Penn Resiliency Program's effect on depressive symptoms. *Journal of Consulting and Clinical Psychology, 77*, 1042-1054. doi: 10.1037/a0017671

* Burton, N. W., Pakenham, K. I., & Brown, W. J. (2010). Feasibility and effectiveness of psychosocial resilience training: A pilot study of the READY program. *Psychology, Health & Medicine, 15*, 266-277. doi: 10.1080/13548501003758710

* Carr, W., Bradley, D., Ogle, A. D., Eonta, S. E., Pyle, B. L., & Santiago, P. (2013). Resilience training in a population of deployed personnel. *Military Psychology, 25*, 148-155. doi: 10.1037/h0094956

- 1 Chartered Institute of Personnel and Development (2009). Employee outlook. Working life in
2 a recession. *Quarterly Survey Report*, 1-29.
- 3 Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, New
4 Jersey: Erlbaum.
- 5 Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The
6 Connor-Davidson resilience scale (CD-RISC). *Depression and Anxiety*, 18, 76-82.
7 doi: 10.1002/da.10113
- 8 Cooper, C. L., Flint-Taylor, J., & Pearn, M. (2013). *Building resilience for success*.
9 Basingstoke: Palgrave Macmillan.
- 10 Egeland, B., Carlson, E., & Sroufe, L. A. (1993). Resilience as process. *Development and*
11 *Psychopathology*, 5, 517-528. doi: 10.1017/S0954579400006131
- 12 Fletcher, D., & Sarkar, M. (2012). A grounded theory of psychological resilience in Olympic
13 champions. *Psychology of Sport and Exercise*, 13, 669-678. doi:
14 10.1016/j.psychsport.2012.04.007
- 15 Fletcher, D., & Sarkar, M. (2013). Psychological resilience: A review and critique of
16 definitions, concepts, and theory. *European Psychologist*, 18, 12-23. doi:
17 10.1027/1016-9040/a000124
- 18 Ford, M.T., Cerasoli, C. P., Higgins, J. A., & Decesare, A. L. (2011) Relationships between
19 psychological, physical, and behavioural health and work performance: A review and
20 meta-analysis. *Work & Stress*, 25, 185-204. doi: 10.1080/02678373.2011.609035
- 21 Geller, E., Weil, J., Blumel, D., Rappaport, A., Wagner, C., & Taylor, R. (2003). *McGraw-*
22 *Hill dictionary of engineering* (2nd Ed.). London: McGraw-Hill.
- 23 Gillham, J. E., Brunwasser, S. M., & Freres, D. R. (2008). Preventing depression in early
24 adolescence: The Penn Resiliency Program. In J. R. Z. Abela & B. L. Hankin (Eds.),
25 *Handbook of depression in children and adolescents* (pp. 309–322). New York, NY:

1 Guilford Press.

2 * Grant, A. M., Curtayne, L., & Burton, G. (2009). Executive coaching enhances goal
3 attainment, resilience and workplace well-being: A randomized controlled study.

4 *Journal of Positive Psychology, 4*, 396-407. doi: 10.1080/17439760902992456

5 Higgins J. P., Altman D. G., Gøtzsche P. C., Jüni P., Moher, D., Oxman A. D., *et al.* (2011).

6 The Cochrane Collaboration's tool for assessing risk of bias in randomized trials.

7 *British Medical Journal, 343*, d5928.

8 Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and*
9 *organizations across nations*. Thousand Oaks, CA: Sage.

10 Houdmont, J., Kerr, R., & Addley, K. (2012). Psychosocial factors and economic recession:

11 The Stormont Study. *Occupational Medicine, 62*, 98-104.

12 doi:10.1093/occmed/kqr216

13 Howe, A., Smajdor, A., & Stokl, A. (2012). Towards an understanding of resilience and its
14 relevance to medical training. *Medical Education, 46*, 349-356. doi:10.1111/j.1365-

15 2923.2011.04188.x

16 Howells, K., & Fletcher, D. (2015). Sink or swim: Adversity- and growth-related experiences
17 in Olympic swimming champions. *Psychology of Sport and Exercise, 16*, 37-48. doi:

18 10.1016/j.psychsport.2014.08.004

19 * Jennings, P. A., Frank, J. L., Snowberg, K. E., Coccia, M. A., & Greenberg, M. T. (2013).

20 Improving classroom learning environments by cultivating awareness and resilience
21 in education (CARE): Results of a randomized controlled trial. *School Psychology*

22 *Quarterly, 28*, 374-390. doi: 10.1037/spq0000035

23 Lazarus, R. S. (1993). From psychological stress to emotions: A history of changing

24 outlooks. *Annual Review of Psychology, 44*, 1-21. doi: 10.1146/annurev.ps.44.

25 Leppin, A. L., Giofriddo, M. R., Sood, A., Montori, V. M., Erwin, P. J., Zeballos-Palacios,

- 1 C., *et al.* (2014). The efficacy of resilience training programs: A systematic review
2 protocol. *Systematic Reviews*, 3, 20-25. doi: 10.1186/2046-4053-3-20.
- 3 * Liossis, P. L., Shochet, I. M., Milllear, P. M., & Biggs, H. (2009). The Promoting Adult
4 Resilience (PAR) program: The effectiveness of the second, shorter pilot of a
5 workplace prevention program. *Behaviour Change*, 26, 97-112. doi:
6 10.1375/behc.26.2.97
- 7 Lu, W., Wang, Z., Liu, Y., & Zhang, H. (2014). Resilience as a mediator between
8 extraversion, neuroticism and happiness, PA and NA. *Personality and Individual
9 Differences*, 63, 128-133. doi: 10.1016/j.paid.2014.01.015
- 10 Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital*. New York, NY:
11 Oxford University Press.
- 12 Masten, A. S., & Reed, M. G. J. (2002). Resilience in development. In C. R. Snyder & S. J.
13 Lopez (Eds.), *Handbook of positive psychology* (pp. 74-88). New York, NY: Oxford
14 University Press.
- 15 Meichenbaum, D. (1985). *Stress inoculation training*. New York, NY: Pergamon.
- 16 * McCraty, R., & Atkinson, M. (2012). Resilience training programme reduces physiological
17 and psychological stress in police officers. *Global Advances in Health and Medicine*,
18 1, 44-66.
- 19 McLarnon, M. J. W., & Rothstein, M. G. (2013). Development and initial validation of the
20 Workplace Resilience Inventory. *Journal of Personnel Psychology*, 12, 63-73. doi:
21 10.1027/1866-5888/a000084
- 22 * Milllear, P., Liossis, P., Shochet, I. M., Biggs, H., & Donald, M. (2008). Being on PAR:
23 Outcomes of a pilot trial to improve mental health and wellbeing in the workplace
24 with the promoting adult resilience (PAR) programme. *Behaviour Change*, 25, 215-
25 228. doi: 10.1375/behc.25.4.215

- 1 Nowack, K. (1990). Initial development of an inventory to assess stress and health. *American*
2 *Journal of Health Promotion*, 4, 173-180. doi: 10.4278/0890-1171-4.3.173
- 3 Office for National Statistics (2013). *Changes in real earnings in the UK and London, 2002*
4 *to 2012*. ONS: London. Retrieved March 11, 2015, from:
5 http://www.ons.gov.uk/ons/dcp171766_299377.pdf
- 6 Pangallo, A., Zibarras, L., Lewis, R., & Flaxman, P. (2015). Resilience through the lens of
7 interactionism: A systematic review. *Psychological Assessment*, 27, 1-20. doi:
8 10.1037/pas0000024
- 9 * Pidgeon, A. M., Ford, L., & Klassen, F. (2014). Evaluating the effectiveness of enhancing
10 resilience in human service professionals using a retreat-based mindfulness with metta
11 training programme: A randomized controlled trial. *Psychology, Health, & Medicine*,
12 19, 355-364. doi: 10.1080/13548506.2013.806815
- 13 * Pipe, T. B., Buchda, V. L., Launder, S., Hudak, B., Hulvey, L., Karns, K. E., & Pendergast,
14 D. (2012). Building personal and professional resources of resilience and agility in the
15 healthcare workplace. *Stress and Health*, 28, 11-22. doi: 10.1002/smi.1396
- 16 Portnoy, D. B., Scott-Sheldon, L. A. J., Johnson, B. T., & Carey, M. P. (2008). Computer-
17 delivered interventions for health promotion and behavioral risk reduction: A meta-
18 analysis of 75 randomized controlled trials (1988-2007). *Preventive Medicine*, 47, 3-
19 16. doi:10.1016/j.ypmed.2008.02.014
- 20 Reivich, K. J., Seligman, M. E. P., & McBride, S. (2011). Master resilience training in the
21 U.S. army. *American Psychologist*, 66, 25-34. doi:10.1037/a0021897
- 22 Richardson, G. E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical*
23 *Psychology*, 58, 307-321. doi: 10.1002/jclp.10020
- 24 Richardson, W. S., Wilson, M. C., Nishikawa, J., & Hayward, R. S. (1995). The well-built
25 clinical question: A key to evidence-based decisions. *ACP Journal Club*, 123, A12-

1 A13.

2 Robertson, I., & Cooper, C. L. (2013). Resilience. *Stress and Health, 29*, 175-176. doi:
3 10.1002/smi.2512

4 Sarkar, M., & Fletcher, D. (2013). How should we measure psychological resilience in sport
5 performers? *Measurement in Physical Education and Exercise Science, 17*, 264-280.
6 doi: 10.1080/1091367X.2013.805141

7 Sarkar, M., & Fletcher, D. (2014). Ordinary magic, extraordinary performance: Psychological
8 resilience and thriving in high achievers. *Sport, Exercise, and Performance
9 Psychology, 3*, 46-60. doi: 10.1037/spy0000003

10 Sarkar, M., Fletcher, D., & Brown, D. J. (in press). What doesn't kill me . . . : Adversity-
11 related experiences are vital in the development of superior Olympic performance.
12 *Journal of Science and Medicine in Sport*. doi: 10.1016/j.jsams.2014.06.010

13 Seery, M. D. (2011). Resilience: A silver lining to experiencing adverse life events. *Current
14 Directions in Psychological Science, 20*, 390-394. doi: 10.1177/0963721411424740

15 Seery, M. D., Holman, E. A., & Silver, R. S. (2010). Whatever does not kill us: Cumulative
16 lifetime adversity, vulnerability and resilience. *Journal of Personality and Social
17 Psychology, 99*, 1025-141. doi: 10.1037/a0021344.

18 * Sherlock-Storey, M., Moss, M., & Timson, S. (2013). Brief coaching for resilience during
19 organisational change – an exploratory study. *The Coaching Psychologist, 9*, 19-26.

20 Simpson, R., Booth, J., Lawrence, M., Byrne, S., Mair, F., & Mercer, S. (2014). Mindfulness
21 based interventions in multiple sclerosis: A systematic review. *BMC neurology, 14*,
22 15. doi:10.1186/1471-2377-14-15

23 Soanes, C., & Stevenson, A. (2006). *Oxford dictionary of English* (2nd Ed). Oxford, UK:
24 Oxford University Press.

25 * Sood, A., Prasad, K., Schroeder, D., & Varkey, P. (2011). Stress management and

- 1 resilience training among Department of Medicine faculty: A pilot randomized
2 clinical trial. *Journal of General Internal Medicine*, 26, 858-861. doi:
3 10.1007/s11606-011-1640-x
- 4 Taris, T. W., & Schreurs, P. J. G. (2009): Well-being and organizational performance: An
5 organizational-level test of the happy-productive worker hypothesis. *Work & Stress*,
6 23, 120-136. doi: 10.1080/02678370903072555
- 7 Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the
8 Resilience Scale. *Journal of Nursing Management*, 1, 165-178.
- 9 * Waite, P. J., & Richardson, G. E. (2003). Determining the efficacy of resiliency training in
10 the work site. *Journal of Allied Health*, 33, 178-183.
- 11 Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical*
12 *Gerontology*, 21, 152-169. doi:10.1017/S0959259810000420
- 13 Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience
14 measurement scales. *Health and Quality of Life Outcomes*, 9, 1-18. doi:
15 10.1186/1477-7525-9-8
- 16 Winwood, P. C., Colon, R., & McEwen, K. (2013). A practical measure of workplace
17 resilience: Developing the Resilience at Work Scale. *Journal of Occupational and*
18 *Environmental Medicine*, 35, 1205-1212. doi: 10.1097/JOM.0b013e3182a2a60a
- 19 Youssef, C., & Luthans, F. (2007). Positive organizational behavior in the workplace: The
20 impact of hope, optimism, and resilience. *Journal of Management*, 33, 774-800. doi:
21 10.1177/0149206307305562

Table 1. SPIO narrow screen inclusion and exclusion criteria

	Inclusion Criteria	Exclusion Criteria
Study Design	Randomised controlled trial, controlled trial, trial.	Qualitative studies, single case studies, systematic review, literature review, methodological papers.
Population	Adults (> 18 years) and any working (employee) samples.	< 18 years and non-work samples.
Intervention	Any specifically resilience-based intervention.	Non-resilience interventions.
Outcomes	Resilience and any mental health, well-being, physical, biological, psychosocial, and performance outcomes.	

Table 2. Study characteristics

Author/Year	Design	Sample	Intervention	Data Collection
Abbott et al (2009)	RCT	Fifty-three sales managers randomly allocated to intervention ($n = 26$; female % = 15; M age = 40.50) or waiting list control ($n = 27$; female = 11; M age = 46.00).	Ten-week online resilience training. Seven core skills based on cognitive therapy: emotion regulation, impulse control, optimism, casual analysis, empathy, self-efficacy, and reaching out.	Pre, post, follow-up.
Arnetz et al (2009)	RCT	Eighteen male police officers randomly allocated to intervention ($n = 9$) and normal practice control ($n = 9$).	Ten-week group-based resilience training. Participants received weekly workshops on relaxation methods, imagery and mental rehearsal.	Pre, post.
Burton et al (2010)	T	Sixteen administrative staff recruited to an intervention group. Overall M age = 36.5, female % = 17%.	Thirteen-week group resilience training. Participants received 11 two-hour sessions that developed; acceptance, cognitive diffusion, mindfulness, self-as-context, values and committed action as well as cognitive behavioral therapy and physical activity promotion.	Pre, post.
Carr et al (2013)	T	One-hundred and sixty U.S. Armed Forces personnel recruited to an intervention group.	Twelve-week Master Resilience Training program. Participants received weekly group training sessions that developed; optimism, problem solving, self-efficacy, self-regulation, emotional awareness, flexibility, empathy and strong relationships.	Pre, post.
Grant et al (2009)	RCT	Forty-one senior managers randomly assigned to intervention and waiting list control groups. Overall M age = 49.84, female % = 93%.	Ten-week group-based and one-to-one resilience training. Provided 360 degrees feedback, half day leadership workshop and four individualised coaching sessions. Coaching used a cognitive-behaviour solution focused approach.	Pre, post.
Jennings et al (2013)	RCT	Fifty school teachers matched and randomised to intervention ($n = 25$) and waiting list control ($n = 25$) groups. Overall M age = 36.00, female % = 89.	Four-week group-based and one-to-one resilience training. 5 full day workshops with 1 one-to-one coaching phone call. Intervention focussed on building emotional skills, mindfulness/stress reduction and compassion practices.	Pre, post.
Liossis et al (2009)	CT	Volunteering civil servants were the intervention group ($n = 19$, M age = 39.4, female % = 84%) and matched university alumni were used as the comparison group ($n = 65$, M age = 39.29, female % = 76%).	Seven-week Promoting Adult Resilience training program. Participants received seven 90-minute group sessions on; understanding and developing personal strengths and resilience, managing stress, changing negative self-talk, promoting positive relationships, problem solving, and conflict resolution.	Pre, post, follow-up.
McCraty & Atkinson (2012)	RCT	Sixty-five police officers randomised to intervention ($n = 29$) and waiting-list control ($n = 36$) groups. Overall M age = 39.00, female % = 10.	Eleven-week group-based resilience training. Focused on self-regulation techniques and scenario-based simulation training.	Pre, post.
Millear et al (2008)	CT	Volunteering employees of a resource sector company were part of intervention	Eleven-week group-based resilience training. Promoting Adult Resilience (PAR); strengths-based program; integrates interpersonal and cognitive behaviour therapy	Pre, post, follow-up.

		group ($n = 9$; M age = 35.40) and matched university alumni were used as a comparison group ($n = 41$; M age = 37.11).	perspectives. Weekly 1-hr session at employees' workplace (delivered in groups of 8=14 people) over 11 consecutive weeks.	
Pidgeon et al (2014)	RCT	Thirty-five human service professionals randomised to an intervention ($n = 21$) and nil-intervention control ($n = 14$) group. Overall M age = 40.70, female % = 91.	Two and a half day group-based retreat resilience training. Followed by booster sessions at 1 and 4 months follow-up. Retreat focus on mindfulness, cognitive therapy strategies, and self-compassion.	Pre, post, follow-up.
Pipe et al (2012)	T	Twenty-nine nurses volunteered for the intervention. Overall M age = ~40, female % = ~90%.	Two positive coping and resilience group sessions conducted over a 3-week period. Session one was five hours and focused on learning how to regulate stress. Session two was a reinforcement session of two hours.	Pre, post.
Sherlock-Storey et al (2013)	T	Twelve public sector middle-managers volunteered for the intervention. Age range = 35-64, female % = 75%.	Six-week resilience coaching intervention. Three one-to-one 90-minute sessions were accompanied by a workbook. Coaching focused on; goal setting, explanatory style, using strengths, social support, self-care, self-efficacy and attaining perspective.	Pre, post.
Sood et al (2011)	RCT	Thirty-two physicians randomly allocated to intervention ($n = 20$; female % = 45; M age = 46.80) or waiting list control ($n = 12$; female = 50; M age = 50.20).	Single 90-min session. Stress Management and Resiliency Training (SMART). Adapted from Attention and Interpretation Therapy (AIT). AIT addresses two aspects of human experience, attention and interpretation. Participants were also provided training in a brief structured relaxation intervention. Participants were offered an optional 30–60 min follow up session depending on individual needs.	Pre, post
Waite & Richardson (2003)	RCT	One-hundred and fifty civil servants randomly allocated to intervention ($n = 73$, M age = ~30, female % = 84%) and nil-intervention control ($n = 77$, M age = ~30, female % = 84) groups.	Five-week resiliency training program. Participants had a seven hour group training program each week, reflecting a total of 35-hours contact. The training focused on understanding resilience, using resilience techniques and developing positive interpersonal relationships.	Pre, post, follow-up.

Table 3. Definitions of resilience

Author/Year	Definition of Resilience
Abbott et al (2009)	“A person’s ability to persevere in the face of challenges, setbacks and conflicts (Reivich & Shatte, 2002)” (p. 89)
Arnetz et al (2009)	No guiding definition provided.
Burton et al (2010)	“The capacity of people to effectively cope with, adjust, or recover from stress and adversity” (p. 266)
Carr et al (2013)	No guiding definition provided.
Grant et al (2009)	No guiding definition provided.
Jennings et al (2013)	No guiding definition provided.
Liopsis et al (2009)	No guiding definition provided.
McCraty & Atkinson (2012)	“The capacity to prepare for, recover from, and adapt to stress, adversity, trauma, or tragedy” (p. 49)
Milleer et al (2008)	No guiding definition provided.
Pidgeon et al (2014)	“Competence to cope and adapt in the face of adversity and to bounce back when stressors become overwhelming” (p. 355)
Pipe et al (2012)	“The ability to adapt to life’s ever-changing landscape and recover quickly from stressors and potential stressors” (p. 11)
Sherlock-Storey et al (2013)	“When beset by problems and adversity sustaining and bouncing back and even beyond to attain success (Luthans et al., 2007)” (p. 22).
Sood et al (2011)	“The ability of an individual to withstand adversity (Connor & Davidson, 2003)” (p. 858)
Waite & Richardson (2003)	“A force within everyone that drives them to seek self-actualization, altruism, and be in harmony with a spiritual source of strength (Richardson, 2002) (p. 179).

Table 4. Resilience outcomes

Author/Year	Outcome (measure)	Intervention effect size (<i>p</i>)	Follow-up effect size
Carr et al (2013)†	Resilience (CD-RISC)	-.20 (.03)	
Grant et al (2009)	Resilience (CHS)	+ve, <i>p</i> < .05*	n/a
Pidgeon et al (2014)	Resilience (RS-14)	+ve, <i>p</i> > .05*	NR
Sherlock-Storey et al (2013)†	Resilience (PCQ)	.71 (.01)	n/a
Sood et al (2011)	Resilience (CD-RISC)	1.16 (.0003)	n/a
Waite & Richardson (2003)	Resilience (RES)	.14 (.41)	.09 (.60)

Note. Intervention effect size reported as Cohen's *d* unless otherwise stated.

†Intervention effect size based on repeated (pre, post), within-group, measures only; *Unable to calculate effect size; -ve = lower intervention mean; +ve = higher intervention mean; NR = Results not reported;

Table 5. Mental health and subjective well-being outcomes

Author/Year	Outcome (measure)	Intervention effect size (<i>p</i>)	Follow-up effect size
Abbott et al (2009)	Depression, anxiety and stress (DASS)	.02 (.81)	NR
	Quality of life (WHOQOL-BREF)	.01 (.97)	
	Happiness (AHI)	.01 (.61)	
Arnetz et al (2009)	Negative mood (POMS)	-1.11 (.03)	n/a
	Stress (VAS)	-.80 (.13)	
Burton et al (2010)†	Autonomy (SPWB)	+ve, <i>p</i> < .05*	n/a
	Mastery (SPWB)	+ve, <i>p</i> < .01*	
	Growth (SPWB)	+ve, <i>p</i> < .01*	
	Positive relations (SPWB)	+ve, <i>p</i> > .05*	
	Purpose (SPWB)	+ve, <i>p</i> > .05*	
	Self-acceptance (SPWB)	+ve, <i>p</i> < .05*	
	Positive affect (PANAS)	+ve, <i>p</i> < .01*	
	Depression (DASS)	-ve, <i>p</i> > .05*	
	Anxiety (DASS)	+ve, <i>p</i> > .05*	
Stress (DASS)	-ve, <i>p</i> < .05*		
Carr et al (2013)†	Stress load	-.08 (> .05)	n/a
Grant et al (2009)	Depression (DASS)	-ve, <i>p</i> < .05*	n/a
	Anxiety (DASS)	-ve, <i>p</i> > .05*	
	Stress (DASS)	-ve, <i>p</i> > .05*	
	Subjective well-being (WWBI)	+ve, <i>p</i> < .05*	
Jennings et al (2013)	Depression (CED-S)	-.45 (.15)	n/a
	Negative affect (PANAS)	-.16 (.13)	
	Positive affect (PANAS)	.24 (.36)	
Liossis et al (2009)	Depression (DASS)	-ve, <i>p</i> > .05*	-ve, <i>p</i> > .05*
	Anxiety (DASS)	-ve, <i>p</i> > .05*	-ve, <i>p</i> > .05*
	Stress (DASS)	-ve, <i>p</i> > .05*	-ve, <i>p</i> > .05*
	Vigour (WVS)	$\eta^2 = .01$ (<i>p</i> > .05)	.81 (.05)
	Psychological well-being (SPWB)	$\eta^2 = .01$ (<i>p</i> > .05)	.76 (.07)
McCarty & Atkinson (2012)	Anxiety (POQS)	-.01 (.89)	n/a
	Depression (POQS)	-.75 (.01)	
	Distress (POQS)	-.62 (.03)	
	Anger (POQS)	-.23 (.37)	
	Sadness (POQS)	-.42 (.11)	

	Negative emotion (POQS)	-.65 (.02)	
	Vitality (POQS)	.53 (.06)	
	Positive emotion (POQS)	.22 (.38)	
Millea et al (2008)	Stress (DASS)	-.46 (.003)	-.96 (.001)
	Psychological well-being (SPWB)	$\eta^2 = .02$ (.29)	$\eta^2 = .02$ (.36)
	Life satisfaction (SWLS)	$\eta^2 = .02$ (.25)	$\eta^2 = .02$ (.40)
Pipe et al (2012)†	Anxiety (POQA)	-1.38 ($p < .01$)	n/a
	Depression (POQA)	-1.54 ($p < .01$)	
	Stress (POQA)	-1.28 ($p < .01$)	
Sood et al (2011)	Stress (PSS)	-1.01 (.01)	n/a
	Anxiety (SAS)	-1.32 (.001)	
	Quality of life (LASA)	0.83 (.03)	
Waite & Richardson (2003)	Purpose (PIL)	.26 (.13)	-.02 (.91)

Note. Intervention effect size reported as Cohen's *d* unless otherwise stated.

†Intervention effect size based on repeated (pre, post), within-group, measures only; *Unable to calculate effect size; -ve = lower intervention mean; +ve = higher intervention mean; NR = Results not reported; $\eta^2 = \text{eta}^2$

Table 6. Physical/biological outcomes

Author/Year	Outcome (measure)	Intervention effect size (<i>p</i>)	Follow-up effect size
Arnetz et al (2009)	Antithrombin	1.03 (.04)	n/a
	Cortisol	-0.89 (.43)	
	Heart rate (BPM)	-0.08 (.90)	
Burton et al (2010)†	Fasting blood glucose	-ve, <i>p</i> > .05*	n/a
	Total Cholesterol	-ve, <i>p</i> < .05*	
	C-Reactive protein	-ve, <i>p</i> > .05*	
	Cortisol	+ve, <i>p</i> > .05*	
	BMI	+ve, <i>p</i> > .05*	
	Systolic blood pressure	-ve, <i>p</i> > .05*	
	Diastolic blood pressure	-ve, <i>p</i> > .05*	
	Minutes/week physical activity	+ve, <i>p</i> > .05*	
Jennings et al (2013)	Physical ill-being (DPS)	-.45 (.15)	n/a
	Exhaustion (MBI)	.04 (.87)	
Liossis et al (2009)	Exhaustion (LOT-R)	$\eta^2 = -.01$ (<i>p</i> < .05)	-.77 (.01)
McCarty & Atkinson (2012)	Fatigue (POQS)	-.31 (.27)	n/a
	Sleeplessness (POQS)	-.29 (.27)	
	Body aches (POQS)	.01 (.99)	
	Indigestion (POQS)	-.40 (.13)	
	Rapid heart rate (POQS)	-.64 (.01)	
Pipe et al (2012)†	Fatigue (POQA)	-1.44 (<i>p</i> < .01)	n/a
Sood et al (2011)	Fatigue (VAS)	-0.23 (0.42)	n/a

Note. Intervention effect size reported as Cohen's *d* unless otherwise stated.

†Intervention effect size based on repeated (pre, post), within-group, measures only; *Unable to calculate effect size; -ve = lower intervention mean; +ve = higher intervention mean. $\eta^2 = \text{eta}^2$

Table 7. Psychosocial outcomes

Author/Year	Outcome (measure)	Intervention effect size (<i>p</i>)	Follow-up effect size
Burton et al (2010)†	Mindfulness (MAAS)	+ve, <i>p</i> < .05*	n/a
	Acceptance (AAQII)	+ve, <i>p</i> < .05*	
	Social support (MOS)	+ve, <i>p</i> > .05*	
Carr et al (2013)†	Morale	-.17 (.01)	n/a
Liossis et al (2009)	Optimism (LOT-R)	$\eta^2 = .01$ (<i>p</i> > .05)	.74 (.02)
	Coping self-efficacy (CSE)	1.17 (.001)	.70 (<i>p</i> > .05)
	Work satisfaction	$\eta^2 = .01$ (<i>p</i> > .05)	.85 (.01)
	Work-life fit	.74 (.001)	.44 (<i>p</i> < .05)
	Work-life balance	.43 (.04)	1.19 (.001)
McCarty & Atkinson (2012)	Peacefulness (POQS)	.51 (.06)	n/a
	Social support (POQS)	.33 (.22)	
	Mental clarity (POQS)	.39 (.14)	
	Goal clarity (POQS)	-.10 (.69)	
	Communication effectiveness (POQS)	-.18 (.49)	
	Work Satisfaction (POQS)	-.29 (.27)	
Millear et al (2008)	Coping self-efficacy (CSE)	1.12 (.004)	1.14 (.002)
	Social skills (SSS)	$\eta^2 = .02$ (.25)	$\eta^2 = .02$ (.39)
	Work-life fit	$\eta^2 = .01$ (.50)	.28 (.05)
	Work-life balance	$\eta^2 = .03$ (.16)	$\eta^2 = .06$ (.09)
	Work Satisfaction	$\eta^2 = .001$ (.75)	$\eta^2 = .002$ (.32)
Pidgeon et al (2014)	Mindfulness (FFMQ)	+ve, <i>p</i> > .05*	
	Self-compassion (SCS)	+ve, <i>p</i> > .05*	
Pipe et al (2012)†	Positive outlook (POQA)	1.09 (<i>p</i> < .01)	n/a
	Motivation (POQA)	1.05 (<i>p</i> < .01)	
	Calmness (POQA)	1.46 (<i>p</i> < .01)	
	Resentfulness (POQA)	-1.04 (<i>p</i> < .01)	
	Anger management (POQA)	-.95 (<i>p</i> < .01)	
Sherlock-Storey et al (2013)†	Hope (PCQ)	.83 (.002)	n/a
	Optimism (PCQ)	.81 (.002)	
	Self-efficacy (PCQ)	.97 (.01)	
Waite & Richardson (2003)	Self-esteem (RSES)	.00 (.99)	-.05 (.77)
	Locus of control (ILOC)	.23 (.20)	.00 (.99)

Job satisfaction (IRS)	.40 (.02)	.17 (.31)
Interpersonal relations (HPLP)	.35 (.04)	.03 (.85)

Note. Intervention effect size reported as Cohen's *d* unless otherwise stated.

†Intervention effect size based on repeated (pre, post), within-group, measures only; *Unable to calculate effect size; -ve = lower intervention mean; +ve = higher intervention mean; NR = Results not reported; $\eta^2 = \text{eta}^2$

Table 8. Performance outcomes

Author/Year	Outcome (measure)	Intervention effect size (<i>p</i>)	Follow-up effect size
Abbott et al (2009)	Gross margin	.05 (.16)	NR
	Product sold	.00 (.76)	
Arnetz et al (2009)	Observed performance	1.26 (.02)	n/a
Carr et al (2013)†	Self-rated performance	.13 (<i>p</i> > .05)	n/a
Grant et al (2009)	Goal attainment (GAS)	+ve, <i>p</i> < .05*	n/a
McCarty & Atkinson (2012)	Productivity (POQS)	-.26 (.33)	n/a
Pipe et al (2012)†	Productivity (POQA)	.97 (<i>p</i> < .01)	n/a

Note. Intervention effect size reported as Cohen's *d* unless otherwise stated.

†Intervention effect size based on repeated (pre, post), within-group, measures only; *Unable to calculate effect size; -ve = lower intervention mean; +ve = higher intervention mean; NR = Results not reported

Table 9. Risk of bias summary for RCT and CT

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of assessors (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data addressed (attrition bias)	Selective outcome reporting (reporting bias)	Other sources of bias (i.e., baseline bias)
Abbott et al (2009)	UNCLEAR	UNCLEAR	HIGH	HIGH	HIGH	HIGH	HIGH
Arnetz et al (2009)	UNCLEAR	HIGH	HIGH	HIGH	UNCLEAR	LOW	UNCLEAR
Grant et al (2009)	UNCLEAR	HIGH	HIGH	HIGH	UNCLEAR	LOW	HIGH
Jennings et al (2013)	UNCLEAR	UNCLEAR	HIGH	HIGH	LOW	LOW	LOW
Liossis et al (2009)	HIGH	HIGH	HIGH	HIGH	LOW	LOW	LOW
McCraty & Atkinson (2012)	UNCLEAR	HIGH	HIGH	HIGH	LOW	LOW	HIGH
Millar et al (2008)	HIGH	HIGH	HIGH	HIGH	HIGH	LOW	LOW
Pidgeon et al (2014)	UNCLEAR	HIGH	HIGH	HIGH	LOW	HIGH	HIGH
Sood et al (2011)	UNCLEAR	HIGH	HIGH	HIGH	LOW	LOW	LOW
Waite & Richardson (2003)	UNCLEAR	UNCLEAR	HIGH	HIGH	HIGH	LOW	HIGH

Note: Low = Low risk of bias; Unclear = Unclear risk of bias; High = High risk of bias.

Table 10. Guidelines on how future researchers can advance knowledge about resilience training

-
- 1 • Definition of resilience
- 2 • Researchers should use a consistent definition of resilience since it will provide scholars with
- 3 conceptual boundaries that will help determine the nature, direction, and veracity of resilience research
- 4 inquiry.
- 5 • We recommend using Fletcher and Sarkar's (2012, 2013) definition of psychological resilience when
- 6 designing and delivering resilience training since it encapsulates aspects of both trait and process
- 7 conceptualizations of resilience.
- 8 • Intervention design and methodological quality
- 9 • Researchers should ideally use randomized controlled designs (i.e., pre-post measures with a control
- 10 group) when conducting resilience training studies.
- 11 • Studies need to adequately describe evidence of sequencing at the randomization stage.
- 12 • Studies need to better conceal participants' allocation to experimental or control groups.
- 13 • Studies need to report data better. Specifically, they need to describe incomplete outcome data (e.g.,
- 14 attrition rates) and avoid selective outcome reporting.
- 15 • Several studies did not report an effect size, making quantitative meta-analysis impossible. Studies need
- 16 to report effect sizes, rather than only statistical significance levels.
- 17 • Studies need to control for baseline measures.
- 18 • Measurement of resilience
- 19 • Only 6/14 studies directly measured resilience. Future work should measure resilience so that
- 20 researchers can better judge the effectiveness of resilience training programmes.
- 21 • Since a number of existing questionnaires measure phenomena that are related to resilience but are
- 22 conceptually distinct from the construct (e.g., hardiness, coping), resilience training studies need to
- 23 employ measures that do not divert researchers' attention from examining the true nature of resilience
- 24 (cf. Sarkar & Fletcher, 2013).
- 25 • Researchers should consider using more contextually-relevant measures including the Resilience at
- 26 Work Scale (RAW; Winwood, Colon, & McEwen, 2013), and the Workplace Resilience Inventory
- 27 (WRI; McLarnon & Rothstein, 2013).
- 28 • Future researchers should assess resilience through the lens of interactionism (see, for a review,
- 29 Pangallo et al., 2015) in line with the recommended definition (Fletcher & Sarkar, 2012, 2013) and the
- 30 process conceptualization of resilience, which recognizes that it is a capacity that develops over time in
- 31 the context of person-environment interactions.
- 32 • Mechanisms of change
- 33 • Future research should identify the processes through which resilience interventions impact resilience
- 34 and other outcome variables (i.e., mental health and subjective well-being, psychosocial,
- 35 physical/biological, and performance outcomes).
- 36 • Researchers should explore a mediated model of resilience to unpack mechanisms of change (i.e.,
- 37 resilience training → increased resilience → secondary outcomes (i.e., mental health and subjective
- 38 well-being, psychosocial, physical/biological, and performance outcomes).
- 39 • Isolation of effects
- 40 • Since resilience training programmes combine multiple elements, future research needs to isolate the
- 41 effects to determine which elements are affecting which outcome measures.
- 42 • Experimental research designs that target specific aspects of resilience may be useful in this regard
- 43 (e.g., measuring an individual's reaction to an experimental stress paradigm).
- 44 • Homogeneity
- 45 • It is vital that future research demonstrates consistency in terms of how resilience is defined,
- 46 conceptualized, developed, and assessed.
- 47 • This will enable the results of resilience training studies to be accumulated and compared via meta-
- 48 analysis.
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Figure 1. Search results flow diagram